We claim:

1. A method of forming a varactor device on a semiconductor substrate, comprising the steps of:

Sub. C1

providing a semiconductor substrate having a first conductivity type;

providing an isolation structure on said semiconductor substrate, said isolation structure defining an implant region;

forming a first implant in said implant region of said isolation structure using a first implant energy, said first implant having a first peak dopant concentration and a second conductivity type, wherein said first implant extends into the implant region a first distance;

forming a second implant in said implant region of said isolation structure using a second implant energy, said second implant having a second peak dopant concentration and said second conductivity type, wherein said second implant extends into the implant region a second distance, wherein said second distance is greater than said first distance.

2. A method in accordance with claim 1, further comprising the step of annealing the device following the steps of forming said first implant and said second implant.

3. A method in accordance with claim 1, further comprising the step of selecting said first peak dopant concentration and first implant energy such that at least one of capacitance, leakage current, and tuning range of the varactor device is optimized.

Sub. C2

4. A method in accordance with claim 3, wherein said selecting step comprises determining an as-implanted dopant concentration profile for said first implant.

5. A method in accordance with claim 4, wherein said step of determining an as-implanted dopant concentration profile is performed using secondary ion mass spectroscopy.

6. A method in accordance with claim 1, further comprising the step of selecting said second peak dopant concentration and said second implant energy such that the base resistance of the varactor device is minimized.

7. A method in accordance with claim 6, wherein said selecting step comprises determining an as-implanted dopant concentration profile for said second implant.

8. A method in accordance with claim 7, wherein said step of determining an as-implanted dopant concentration profile is performed using secondary ion mass spectroscopy.

Sub D2

9. A method of forming a varactor device on a semiconductor substrate, comprising the steps of:

providing a semiconductor substrate having a first conductivity type;

providing an isolation structure on said semiconductor substrate, said isolation structure defining an implant region;

forming a first implant in said implant region of said isolation structure using a first implant energy, said first implant having a first peak dopant concentration and a second conductivity type, wherein said first implant extends into the implant region a first distance;

forming a second implant in said implant region of said isolation structure using a second implant energy, said second implant having a second peak dopant concentration and said second conductivity type, wherein said second implant extends into the implant region a second distance,

wherein said second distance is greater than said first distance, wherein said first peak dopant concentration and said first implant energy are selected such that at least one of capacitance, leakage current, and tuning range of the varactor device are optimized, and wherein said second peak dopant concentration and said second implant energy are selected with relation to said first peak dopant concentration and said first implant energy such that the base resistance of the varactor device is minimized.

10. A semiconductor structure comprising a varactor device formed by the method of claim 1.

11. A semiconductor structure comprising a varactor device formed by the method of claim 9.

12. A semiconductor structure having a varactor device formed therein, comprising:

a semiconductor substrate having a first conductivity type;

an isolation structure on said semiconductor substrate, said isolation structure defining an implant region;

a first implant in said implant region of said isolation structure, said first implant having a first peak dopant concentration and a second conductivity type, wherein said first implant extends into the implant region a first distance;

a second implant in said implant region of said isolation structure, said second implant having a second peak dopant concentration and said second conductivity type, wherein said second implant extends into the implant region a second distance, wherein said second distance is greater than said first distance.

13. A semiconductor structure in accordance with claim 12 wherein said first conductivity type is N-type.

14. A semiconductor structure in accordance with claim 12 wherein said first conductivity type is P-type.

15. A semiconductor structure in accordance with claim 12 wherein said first implant is configured such that at least one of capacitance, leakage current, and tuning range of the varactor device are optimized.

16. A semiconductor structure in accordance with claim 12 wherein said second implant is configured with relation to said first implant such that the base resistance of the varactor device is minimized.